

1      **WHAT IS CLAIMED IS:**

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3            1.       A method of operating an on-line MPEG video encoder during real-time  
4       encoding of an incoming video stream to produce an MPEG Transport Stream, the  
5       incoming video stream having video frames, the video frames having respective time  
6       codes, said method comprising:

7                  the on-line MPEG video encoder comparing the time codes of video frames in a  
8       first portion of the incoming video stream to a first time code specification to locate, in  
9       the incoming video stream, a first video frame having a time code specified by the first  
10      time code specification, and the on-line MPEG video encoder starting a new closed group  
11      of pictures (GOP) in the MPEG Transport Stream including the first video frame encoded  
12      as a first I frame of the new closed GOP, and

13                  the on-line MPEG video encoder comparing the time codes of video frames in a  
14       second portion of the incoming video stream to a second time code specification to  
15       identify, in the incoming video stream, a second video frame having a time code specified  
16       by the second time code specification, and the on-line MPEG video encoder terminating a  
17       GOP in the MPEG transport stream to produce a terminated GOP, the terminated GOP  
18       having a last video frame immediately preceding the second video frame.

19

20            2.       The method as claimed in claim 1, wherein the time codes of the video  
21       frames in the incoming video stream are time codes included in the incoming video  
22       stream, and the on-line MPEG video encoder extracts the time codes from the incoming  
23       video stream.

1           3.       The method as claimed in claim 1, wherein the time codes of the video  
2       frames in the incoming video stream are longitudinal time codes, the on-line MPEG  
3       video encoder obtains the video stream from a video stream input, and the on-line MPEG  
4       video encoder obtains the longitudinal time codes from a longitudinal time code input.

5

6           4.       The method as claimed in claim 1, which further includes the on-line  
7       MPEG video encoder inserting the time code for the first video frame in a header of the  
8       new closed GOP in the MPEG Transport Stream, and the on-line MPEG video encoder  
9       inserting the time code for the second video frame in a header for a GOP in the MPEG  
10      Transport Stream immediately following the terminated GOP.

11

12           5.       The method as claimed in claim 4, which further includes a video server  
13      receiving the MPEG Transport Stream and searching the MPEG Transport Stream for the  
14      time code of the first video frame and searching the MPEG Transport Stream for the time  
15      code of the second video frame in order to store a clip of video frames including the new  
16      closed GOP and the terminated GOP and GOPs between the new closed GOP and the  
17      terminated GOP.

18

19           6.       The method as claimed in claim 1, which includes the MPEG video  
20      encoder terminating the terminated GOP with a B or P frame to produce a splice Out-  
21      point.

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1           7.       The method as claimed in claim 1, which includes the MPEG video  
2       encoder producing an open GOP immediately following the new closed GOP.

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4           8.       The method as claimed in claim 1, which further includes the video  
5       encoder searching for video frames in the incoming video that have the time codes  
6       specified by time code specifications in a list of time code specifications for splice points  
7       in order to encode closed GOPs having initial I frames in the MPEG Transport Stream for  
8       each of the splice points.

9

10          9.       A method of operating an on-line MPEG video encoder during real-time  
11       encoding of an incoming video stream to produce an MPEG Transport Stream, said  
12       method comprising:

13           the on-line MPEG video encoder comparing time codes of video frames in the  
14       incoming video stream to a list of time code specifications for splice points, and upon  
15       finding a time code in the incoming video stream specified by a time code specification  
16       for a splice point in the list, the on-line MPEG video encoder starting a new closed group  
17       of pictures (GOP) in the MPEG Transport Stream, the new closed GOP including a video  
18       frame having the time code specified by the specification for the splice point in the list,  
19       and the video frame having the time code specified by the specification for the splice  
20       point in the list being encoded as a first I frame of the new closed GOP.

21

22          10.      The method as claimed in claim 9, wherein the time codes of the video  
23       frames in the incoming video stream are time codes included in the incoming video

1 stream, and the on-line MPEG video encoder extracts the time codes from the incoming  
2 video stream.

3

4 11. The method as claimed in claim 9, wherein the time codes of the video  
5 frames in the incoming video stream are longitudinal time codes, the on-line MPEG  
6 video encoder obtains the video stream from a video stream input, and the on-line MPEG  
7 video encoder obtains the longitudinal time codes from a longitudinal time code input.

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9 12. The method as claimed in claim 9, which further includes the on-line  
10 MPEG video encoder inserting the time code specified by the specification for the splice  
11 point in the list into a header for the new closed GOP in the MPEG Transport Stream.

12

13 13. The method as claimed in claim 9, wherein the new GOP is immediately  
14 preceded by a terminated GOP, and wherein the method includes the on-line MPEG  
15 video encoder terminating the terminated GOP with a B or P frame to produce a splice  
16 Out-point.

17

18 14. A method of operating an on-line MPEG video encoder and a video  
19 server, the on-line MPEG video encoder encoding in real time an incoming video stream  
20 to produce an MPEG Transport Stream, the video server receiving the MPEG Transport  
21 Stream and recording a segment of the MPEG Transport Stream as a clip, the incoming  
22 video stream including video frames, the video frames having respective time codes, said  
23 method comprising:

1           the on-line MPEG video encoder comparing the time codes of video frames in a  
2       first portion of the incoming video stream to a time code specification for a first video  
3       frame to be included in the clip in order to locate, in the incoming video stream, a first  
4       video frame to be included in the clip, and the on-line MPEG video encoder starting a  
5       new closed group of pictures (GOP) in the MPEG Transport Stream, the new closed GOP  
6       including the first video frame to be included in the clip as a first I frame of the new  
7       closed GOP, and

8           the on-line MPEG video encoder comparing the time codes of video frames in a  
9       second portion of the incoming video stream to a time code specification for a last video  
10      frame to be included in the clip in order to locate, in the incoming video stream, the last  
11      video frame to be included in the clip, and the on-line MPEG video encoder terminating a  
12      GOP in the MPEG transport stream to produce a terminated GOP encoding the last video  
13      frame to be included in the clip as the last video frame in the terminated GOP; and

14           the on-line MPEG video encoder inserting, in a GOP header for each GOP in the  
15      transport stream, a time code of at least the first video frame to be displayed from the  
16      GOP; and

17           the video server searching the time codes in the GOP headers in the MPEG  
18      Transport Stream to locate the first video frame to be included in the clip and to record  
19      the clip in storage of the video server.

20

21           15.     The method as claimed in claim 14, wherein the time codes of the video  
22      frames in the incoming video stream are time codes included in the incoming video

1 stream, and the on-line MPEG video encoder extracts the time codes from the incoming  
2 video stream.

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4 16. The method as claimed in claim 14, wherein the time codes of the video  
5 frames in the incoming video stream are longitudinal time codes, the on-line MPEG  
6 video encoder obtains the video stream from a video stream input, and the on-line MPEG  
7 video encoder obtains the longitudinal time codes from a longitudinal time code input.

8

9 17. The method as claimed in claim 14, which includes the on-line MPEG  
10 video encoder terminating the terminated GOP with a B or P frame to produce a splice  
11 Out-point.

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13 18. The method as claimed in claim 14, which includes the on-line MPEG  
14 video encoder producing an open GOP immediately following the new closed GOP.

15

16 19. The method as claimed in claim 14, which further includes the on-line  
17 MPEG video encoder searching for video frames in the incoming video that have time  
18 codes for specified splice points in order to encode a closed GOP having an initial I frame  
19 in the MPEG Transport Stream for each of the specified splice points.

20

21 20. A method of operating an on-line MPEG-2 video encoder and a video  
22 server, the on-line MPEG-2 video encoder encoding in real time an incoming video  
23 stream to produce an MPEG-2 Transport Stream, the video server receiving the MPEG-2

1 Transport Stream and recording a segment of the MPEG-2 Transport Stream as a clip, the  
2 incoming video stream including video frames, the video frames having respective time  
3 codes, said method comprising:

4 a controller receiving from an operator a specification for the video frames to be  
5 included in the clip;

6 the controller establishing a data link with the on-line MPEG-2 video encoder and  
7 with the video server, and transmitting to the encoder and the video server the  
8 specification for the video frames to be included in the clip;

9 the on-line MPEG-2 video encoder comparing the time codes of video frames in  
10 the incoming video stream to a time code specification for a first video frame to be  
11 included in the clip in order to locate, in the incoming video stream, a first video frame to  
12 be included in the clip, and the on-line MPEG-2 video encoder starting a new closed  
13 group of pictures (GOP) in the MPEG-2 Transport Stream, the new closed GOP  
14 including the first video frame to be included in the clip as a first I frame of the new  
15 closed GOP, the on-line MPEG-2 video encoder inserting at least the time code for the  
16 first video frame to be included in the clip into a GOP header for the new closed GOP in  
17 the MPEG-2 transport stream, and the on-line MPEG-2 video encoder terminating a GOP  
18 in the MPEG-2 Transport Stream to produce a terminated GOP encoding a last video  
19 frame to be encoded in the clip as the last video frame in the terminated GOP; and

20 the video server searching the MPEG-2 Transport Stream for the video frame  
21 having the time code for the first video frame to be included in the clip to locate the first  
22 video frame to be included in the clip, and the video server recording the clip in storage  
23 of the video server.

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2        21. The method as claimed in claim 20, wherein the time codes of the video  
3 frames in the incoming video stream are time codes included in the incoming video  
4 stream, and the on-line MPEG video encoder extracts the time codes from the incoming  
5 video stream.

6

7        22. The method as claimed in claim 20, wherein the time codes of the video  
8 frames in the incoming video stream are longitudinal time codes, the on-line MPEG  
9 video encoder obtains the video stream from a video stream input, and the on-line MPEG  
10 video encoder obtains the longitudinal time codes from a longitudinal time code input.

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12

13        23. The method as claimed in claim 20, which includes the on-line MPEG-2  
14 video encoder terminating the terminated GOP with a B or P frame to produce a splice  
15 Out-point.

16

17        24. The method as claimed in claim 20, which includes the on-line MPEG-2  
18 video encoder producing an open GOP immediately following the new closed GOP.

19

20        25. The method as claimed in claim 20, which further includes the on-line  
21 MPEG-2 video encoder receiving from the controller a list of time codes for splice points  
22 in the clip, and the on-line MPEG-2 video encoder searching for video frames in the  
23 incoming video stream that have the time codes for the splice points in order to encode a

1 closed GOP having an initial I frame in the MPEG-2 Transport Stream for each of the  
2 splice points.

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4        26.      The method as claimed in claim 20, wherein the controller sends remote  
5 procedure calls to the on-line MPEG-2 video encoder in order to supervise the encoding  
6 process performed by the on-line MPEG-2 video encoder.

7

8        27.      An on-line MPEG video encoder for real-time encoding of an incoming  
9 video stream to produce an MPEG Transport Stream, the incoming video stream having  
10 video frames, the video frames having respective time codes,

11                the on-line MPEG video encoder having a data link input for receiving remote  
12 control commands including time code specifications from an external controller,

13                the on-line MPEG video encoder being programmed for comparing the time  
14 codes of video frames in a first portion of the incoming video stream to a first time code  
15 specification to locate, in the incoming video stream, a first video frame having a time  
16 code specified by the first time code specification, and to start a new closed group of  
17 pictures (GOP) in the MPEG Transport Stream including the first video frame encoded as  
18 a first I frame of the new closed GOP, and

19                the on-line MPEG video encoder being programmed to compare the time codes of  
20 video frames in a second portion of the incoming video stream to a second time code  
21 specification to identify, in the incoming video stream, a second video frame having a  
22 time code specified by the second time code specification, and to terminate a GOP in the

1       MPEG transport stream to produce a terminated GOP, the terminated GOP having a last  
2       video frame immediately preceding the second video frame.

3

4           28.      The on-line MPEG video encoder as claimed in claim 27, wherein the  
5       time codes of the video frames in the incoming video stream are time codes included in  
6       the incoming video stream, and the on-line MPEG video encoder is programmed to  
7       extract the time codes from the incoming video stream.

8

9           29.      The on-line MPEG video encoder as claimed in claim 27, wherein the  
10      time codes of the video frames in the incoming video stream are longitudinal time codes,  
11      the on-line MPEG video encoder has a video stream input for input of the incoming video  
12      stream, and the on-line MPEG video encoder has a longitudinal time code input for input  
13      of the longitudinal time codes of the video frames in the incoming video stream.

14

15           30.      The on-line MPEG video encoder as claimed in claim 27, wherein the on-  
16      line MPEG video encoder is further programmed to insert the time code for the first  
17      video frame in a header of the new closed GOP in the MPEG Transport Stream, and to  
18      insert the time code for the second video frame in a header for a GOP in the MPEG  
19      Transport Stream immediately following the terminated GOP.

20

21           31.      The on-line MPEG video encoder as claimed in claim 27, wherein the on-  
22      line MPEG video encoder is programmed to terminate the terminated GOP with a B or P  
23      frame to produce a splice Out-point.

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2       32.     The on-line MPEG video encoder as claimed in claim 27, wherein the on-  
3                  line MPEG video encoder is programmed to produce an open GOP immediately  
4                  following the new closed GOP.

5

6       33.     The on-line MPEG video encoder as claimed in claim 27, wherein the on-  
7                  line MPEG video encoder is programmed for receiving from the data link a list of time  
8                  code specifications for splice points between the first video frame and the second video  
9                  frame, and searching for video frames in the incoming video that have the time codes  
10                 specified for the splice points in order to encode closed GOPs having initial I frames in  
11                 the MPEG Transport Stream for the splice points.

12

13

14       34.     An on-line MPEG video encoder for real-time encoding of an incoming  
15                  video stream to produce an MPEG Transport Stream, the incoming video stream having  
16                  video frames, the video frames having respective time codes,  
17                  the on-line MPEG video encoder having a data link input for receiving remote  
18                 control commands including time code specifications from an external controller,  
19                  the on-line MPEG video encoder being programmed for comparing time codes of  
20                  video frames in the incoming video stream to a list of time code specifications for splice  
21                  points, and upon finding a video frame in the incoming video stream having a time code  
22                 specified by a time code specification for a splice point in the list, for starting a new  
23                 closed group of pictures (GOP) in the MPEG Transport Stream, the new closed GOP

1 including a video frame having the time code specified by the specification for the splice  
2 point in the list, and the video frame having the time code specified by the specification  
3 for the splice point in the list being encoded as a first I frame of the new closed GOP.

4

5       35. The on-line MPEG video encoder as claimed in claim 34, wherein the  
6 time codes of the video frames in the incoming video stream are time codes included in  
7 the incoming video stream, and the on-line MPEG video encoder is programmed to  
8 extract the time codes from the incoming video stream.

9

10       36. The on-line MPEG video encoder as claimed in claim 34, wherein the  
11 time codes of the video frames in the incoming video stream are longitudinal time codes,  
12 the on-line MPEG video encoder has a video stream input for input of the incoming video  
13 stream, and the on-line MPEG video encoder has a longitudinal time code input for input  
14 of the longitudinal time codes of the video frames in the incoming video stream.

15

16       37. The on-line MPEG video encoder as claimed in claim 34, wherein the on-  
17 line MPEG video encoder is further programmed for inserting the time code specified by  
18 the specification for the splice point in the list into a header for the new closed GOP in  
19 the MPEG Transport Stream.

20

21       38. The on-line MPEG video encoder as claimed in claim 34, wherein the new  
22 GOP is immediately preceded by a terminated GOP, and wherein the on-line MPEG

1       video encoder is programmed for terminating the terminated GOP with a B or P frame to  
2       produce a splice Out-point.

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4

5           39.     A video encoding and recording system comprising:  
6               an on-line MPEG video encoder for encoding in real time an incoming video  
7               stream to produce an MPEG Transport Stream, the incoming video stream including  
8               video frames, the video frames having respective time codes; and  
9               a video server coupled to the on-line MPEG video encoder for receiving the  
10          MPEG Transport Stream and recording a segment of the MPEG Transport Stream as a  
11          clip;

12               wherein the on-line MPEG video encoder is programmed for comparing the time  
13          codes of video frames in a first portion of the incoming video stream to a time code  
14          specification for a first video frame to be included in the clip in order to locate, in the  
15          incoming video stream, a first video frame to be included in the clip, and for starting a  
16          new closed group of pictures (GOP) in the MPEG Transport Stream, the new closed GOP  
17          including the first video frame to be included in the clip as a first I frame of the new  
18          closed GOP, and

19               wherein the on-line MPEG video encoder is programmed for comparing the time  
20          codes of video frames in a second portion of the incoming video stream to a time code  
21          specification for a last video frame to be included in the clip in order to locate, in the  
22          incoming video stream, the last video frame to be included in the clip, and for terminating

1 a GOP in the MPEG transport stream to produce a terminated GOP encoding the last  
2 video frame to be included in the clip as the last video frame in the terminated GOP; and  
3 wherein the on-line MPEG video encoder is programmed for inserting, in a GOP  
4 header for each GOP in the transport stream, a time code of at least the first video frame  
5 to be displayed from the GOP; and  
6 the video server is programmed for searching the time codes in the GOP headers  
7 in the MPEG Transport Stream to locate the first video frame to be included in the clip  
8 and to record the clip in storage of the video server.

9

10 40. The system as claimed in claim 39, wherein the time codes of the video  
11 frames in the incoming video stream are time codes included in the incoming video  
12 stream, and the on-line MPEG video encoder is programmed to extract the time codes  
13 from the incoming video stream.

14

15 41. The system as claimed in claim 39, wherein the time codes of the video  
16 frames in the incoming video stream are longitudinal time codes, the on-line MPEG  
17 video encoder has a video stream input for input of the incoming video stream, and the  
18 on-line MPEG video encoder has a longitudinal time code input for input of the  
19 longitudinal time codes of the video frames in the incoming video stream.

20

21 42. The system as claimed in claim 39, wherein the on-line MPEG video  
22 encoder is programmed for terminating the terminated GOP with a B or P frame to  
23 produce a splice Out-point.

1  
2       43. The system as claimed in claim 39, wherein the on-line MPEG video  
3       encoder is programmed for producing an open GOP immediately following the new  
4       closed GOP.

5  
6       44. The system as claimed in claim 39, wherein the on-line MPEG video  
7       encoder is programmed for searching for video frames in the incoming video that have  
8       time codes for specified splice points in order to encode a closed GOP having an initial I  
9       frame in the MPEG Transport Stream for each of the specified splice points.

10  
11  
12       45. A video encoding and recording system comprising:  
13           an on-line MPEG-2 video encoder for encoding in real time an incoming video  
14           stream to produce an MPEG-2 Transport Stream, the incoming video stream including  
15           video frames, the video frames having respective time codes; and  
16           a video server coupled to the on-line MPEG-2 video encoder for receiving the  
17           MPEG Transport Stream and recording a segment of the MPEG Transport Stream as a  
18           clip; and  
19           a controller for receiving from an operator a specification for the video frames to  
20           be included in the clip and coupled by at least one data link to the on-line MPEG-2 video  
21           encoder and the video server for transmitting to the on-line MPEG-2 video encoder and  
22           to the video server the specification for the video frames to be included in the clip;

1           wherein the on-line MPEG-2 video encoder is programmed for comparing time  
2        codes of video frames in the incoming video stream to a time code specification for a first  
3        video frame to be included in the clip in order to locate, in the incoming video stream, a  
4        first video frame to be included in the clip, and for starting a new closed group of pictures  
5        (GOP) in the MPEG-2 Transport Stream, the new closed GOP including the first video  
6        frame to be included in the clip as a first I frame of the new closed GOP, and the on-line  
7        MPEG-2 video encoder is programmed for inserting at least the time code for the first  
8        video frame to be included in the clip into a GOP header for the new closed GOP in the  
9        MPEG-2 transport stream, and the on-line MPEG-2 video encoder is further programmed  
10      for terminating a GOP in the MPEG-2 Transport Stream to produce a terminated GOP  
11      encoding a last video frame to be encoded in the clip as the last video frame in the  
12      terminated GOP; and

13           wherein the video server is programmed for searching the MPEG-2 Transport  
14      Stream for the time code for the first video frame to be included in the clip to locate the  
15      first video frame to be included in the clip, and for recording the clip in storage of the  
16      video server.

17  
18          46.       The system as claimed in claim 45, wherein the time codes of the video  
19        frames in the incoming video stream are time codes included in the incoming video  
20        stream, and the on-line MPEG-2 video encoder is programmed to extract the time codes  
21        from the incoming video stream.

22

1           47. The system as claimed in claim 45, wherein the time codes of the video  
2 frames in the incoming video stream are longitudinal time codes, the on-line MPEG-2  
3 video encoder has a video stream input for input of the incoming video stream, and the  
4 on-line MPEG-2 video encoder has a longitudinal time code input for input of the  
5 longitudinal time codes of the video frames in the incoming video stream.

6

7           48. The system as claimed in claim 45, wherein the on-line MPEG-2 video  
8 encoder is programmed for terminating the terminated GOP with a B or P frame to  
9 produce a splice Out-point.

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11           49. The system as claimed in claim 45, wherein the on-line MPEG-2 video  
12 encoder is programmed for producing an open GOP immediately following the new  
13 closed GOP.

14

15           50. The system as claimed in claim 45, wherein the on-line MPEG-2 video  
16 encoder is programmed for receiving from the controller a list of time codes for splice  
17 points in the clip, and for searching for video frames in the incoming video stream that  
18 have the time codes for the splice points in order to encode a closed GOP having an  
19 initial I frame in the MPEG-2 Transport Stream for each of the splice points.

20

21           51. The system as claimed in claim 45, wherein the controller sends remote  
22 procedure calls to the on-line MPEG-2 video encoder in order to supervise the encoding  
23 process performed by the on-line MPEG-2 video encoder.